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UDRI Researchers Develop Glasses-Mounted Display, Next Generation of Wearable Computers

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Contact: Pam Huber
huber@udayton.edu

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NEWS RELEASE

UDRI RESEARCHERS DEVELOP GLASSES-MOUNTED DISPLAY, NEXT GENERATION OF WEARABLE COMPUTERS

DAYTON, Ohio — A "wearable computer" could be a wristwatch that gives you stock quotes or a belt-hooked navigator that uses satellite data to give you directions around town. Or, better yet, it could be a small laptop that projects whatever is on the screen onto the inside of your glasses, letting you read instructions while you finish a repair, for example, with both hands free to do the work.

It's called a "glasses-mounted display," or GMD, and it's one version of a wearable computer that soon may be as familiar as a Game Boy.

"If you're working on something where you need two hands, you can easily look at the display to access information and then look back at your project," said Allen R. Revels, senior system software engineer with the human factors group of the University of Dayton Research Institute. "The whole objective is to be able to see as much of the outside world as possible."

The human factors group, with Revels as principal investigator, is working on phase two of the wearable computer project, slated to run through April. The Technology Partnership, a high-technology innovation and development company based in Grosse Ile, Mich., developed and patented the technology and obtained a $700,000 small business innovative research grant funded by the Department of Defense through the Air Force Research Laboratory to evaluate the product. Revels is testing a number of GMD prototypes under UDRI's $250,000 subcontract.

"There are numerous technologies for glasses and goggles displays that are used for everything from flying jets to merely telling the time," said David Bettinger, president of The Technology Partnership. "Our advantage is that we add so little weight to the glasses. Our optics are so light-weight they're almost covert."

The project is sponsored by the human effectiveness directorate of the Air Force Research Lab at Wright Patterson Air Force Base. The technology grew out of the Air Force need

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OFFICE OF PUBLIC RELATIONS
300 College Park Dayton, Ohio 45469-1679
(937) 229-3241 (937) 229-3063 Fax
www.udayton.edu

for aircraft maintenance personnel to have detailed repair and support information available on the flight line along with the ability to work with both hands.

On The Technology Partnership prototype, a cable feeds from a small notebook computer to the back of one of the earpieces of the glasses, where the cable is attached to the earpiece up to the lens. At the end of the cable, mounted near the temple, is a small microscreen with an image that is reflected by a small mirror to the eye.

The microscreen display is a product manufactured by Planar Inc. in Beaverton, Ore.

The display is self-illuminating, using active matrix electro-luminescence technology. The computer display is sharp and readily apparent to the viewer in the upper right quarter of the field of vision, and only a small portion of peripheral vision is restricted.

Except for the cable, the prototypes look much like ordinary pairs of glasses, and the display is visible only to the wearer.

"It's very light — about nine grams — and when it's manufactured, the precise size of the mirror and coating on the lens can be form-fitted to individuals to make it as effective as possible," Revels said. "The cable would be embedded within the earpiece, and the computer could be built into a belt or held in a fanny pack."

Now controlled by a standard, if small, keyboard, the display could also be manipulated by other controls. Researchers are looking at trackball controls as well as more exotic controls, such as those activated by eye or muscle movement.

Its eventual cost? "Probably the cost of a computer monitor, somewhere below $1,000," Revels estimates. Whether or not the product has the necessary function and appeal to bring it to market will most likely be decided within two years, he said. Evaluating commercialization of the product will be done in phase three of the project.

Any drawbacks? "People with long eyelashes can have a problem," he said with a grin.

"It's on the leading edge of technology in that it's useful and usable," Revels said. "It's been field tested and was found to be very useful in a mobile environment. It's been very well received by the people who have used it."

In the future, GMD could provide hands-free, cell phone videoconferencing, where you and the person on the other end of the line "see" each other as you talk, Revels said. The private nature of the display could allow a stock trader to have complete confidence in the privacy of his or her trades, even those made in the middle of a busy restaurant.

Bettinger sees a host of niche markets for the GMD technology, which could be used to provide everything from a personal appointment reminder to "silent attack" communication for special forces.

"A marathoner could monitor his or her pulse throughout the entire race," he says. "The earpiece of the glasses is right next to the superficial temporal artery, so you could monitor blood pressure. For companies with a matrix management style, the display could help team members exchange information that may not ever enter their conversation but would allow sharing of another channel of information. And that could change the way we work."

Mobile computing has evolved over the past 20 years, as computer power and technology have become available in smaller and smaller housings, said Revels, a 1980 graduate of Wayne High School who is pursuing his doctorate in human factors engineering through the DAGSI (Dayton Area Graduate Studies Institute) program.

Intrigued by technology and logic since his teen years, Revels spent 12 years in the military. For 10 of those years, he was a member of a B-52 crew as an electronic warfare officer.

"The guy who lived across the street from me in Huber Heights was a doctor, and he gave me a slide rule when I was 13 years old. I thought it was great. Everybody else had all those calculators, but I discovered that I could do the same things on that slide rule."

It's not his call, he said, to determine whether the world needs more technology. "The trend is that everyone is busier and more mobile, yet still techno-centric and connected. We have pagers and cell phones and laptops and Internet access — we want information at our fingertips and we want it now. Whether that's good, bad or indifferent is not for me to say. That's for users to say."

Although other forms of wearable computers have promise, he said this is the one he'd bank on. "With all of the technology that's out there, given the state of the art, this would probably be the one I would buy. It's a simple way of designing things, and it seems so instinctive to do it this way. That's the beauty of it."

The University of Dayton Research Institute, the largest nonmedical reserach facility on a Catholic university campus, employs more than 350 employees and conducts more than $40 million in sponsored research annually through some 750 contracts.

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For media interviews, contact **Allen R. Revels,** a resident of Springboro, at (937) 256-9243 or via e-mail at revels@udri.udayton.edu and **David Bettinger** at (734) 675-8295 or via e-mail at techpart@home.com.